

(19)



Europäisches Patentamt

European Patent Office

Office européen des brevets

(11)

Publication number:

0 029 273
A1

(12)

EUROPEAN PATENT APPLICATION

(21) Application number: 80201084.3

(51) Int. Cl.³: E 02 D 5/04

(22) Date of filing: 12.11.80

(30) Priority: 12.11.79 NL 7908273

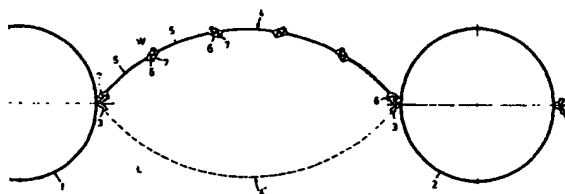
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(64) Designated Contracting States: BE DE FR GB IT NL SE

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(54) A method of making a sheet-pile wall and a wall made by said method.

(57) A composite sheet-pile wall comprising piles (1, 2) driven into the ground in spaced relationship and a screen (4) of sheet piles (5) connecting said piles (1, 2). The piles (1, 2) and the sheet piles (5) are connected together by interlocks (6, 7). The wall is made by first driving in the pile (1, 2) and then placing the screen (4) as a whole, either by driving in the sheet piles (5) all at the same time, or driving them in incrementally and alternately at least two at a time, and in such a manner that, in plan view, the respective interlocks (6, 7) are located on a curved line.

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A method of making a sheet-pile wall and a wall made by said method.

5 This invention relates to a method of making a retaining wall, in particular a composite wall composed of piles, driven into the ground in spaced relationship and sheet piles interconnecting said piles and connected to each other and to said piles by means of interlocks.

Such walls, in which the piles consist of singular or composite double-T sections interconnected by sheet piles of bent cross-sectional shape are known in the art. The double-T sections are driven into the ground with their
10 flanges extending in the longitudinal direction of the wall.

The disadvantage of using such sections in making a composite wall is that, as a result of the fact that such sections, as viewed in cross-section, are extremely rigid in the direction of their web, but transversely thereto, i.e., in the longitudinal direction of the wall
15 exhibit very little rigidity, the sections are apt to deviate from the desired directions as they are being driven into the ground. Such deviations cannot be taken up by the interlocks, and as a consequence subterranean
20 leakages occur, the repair of which is extremely expensive in practice.

It is an object of the present invention to avoid this drawback.

For this purpose, in a method as defined in
25 the opening paragraph, after the piles have been driven in, these are interconnected by a flexible screen which is placed as a whole by either driving in all the sheet piles

simultaneously or driving them in incrementally and alternately at least two at a time, the sheet piles being placed in such an arrangement that, in horizontal section, their respective coupling points are spaced on a curve.

- 5 The direction of curvature will be selected in dependence upon the specific application so that the screen is predominantly subjected to tensile forces from ground and/or water and/or air present on opposite sides thereof.

- 10 If necessary, according to the invention, the ground between the driven-in piles may be loosened before the flexible screen is driven in.

- As the coupling points lie on a curved line, i.e. the interlocks lie on a curved cylindrical surface, the sum of the clearance present in the interlocks imparts
15 sufficient flexibility to the screen for compensating for major deviations in pile orientation both longitudinally of the wall and at right angles thereto.

- In order to minimize such pile deviations right from the start, the piles used for making the composite
20 wall according to the present invention are preferably tubular piles.

According to the invention, the screen comprises at least two, but preferably at least three piles to ensure good flexibility.

- 25 The invention also relates to a composite sheet-pile wall made in accordance with the invention.

In a preferred embodiment of the invention, the composite sheet-pile wall according to the invention

comprises tubular piles driven into the ground in spaced relationship, which piles are on their facing sides equipped with one or more lock needles, with a flexible screen of sheet piles extending between the piles, said
5 sheet piles being interconnected by interlocks, which screen comprises at least two sheet piles and is connected to the pile lock needles, said lock needles and the interlocks between the sheet piles extending in a curved surface.

For optimum strength and flexibility of the
10 screen, according to the invention, the sheet piles may each be of curved cross-sectional configuration.

Furthermore, according to the invention, the lock needles connected to the tubular piles may be of duplicate construction so that a second screen may be
15 driven in between two successive tubular piles, which second screen is curved away from the first screen. The space between the screens can be emptied and thus be made accessible for inspection in an easy manner, or it may be filled with concrete

20 One embodiment of the invention will now be described, by way of example, with reference to the accompanying drawing.

The drawing shows in plan view two driven-in tubular piles 1 and 2 provided on opposite sides with a
25 double lock needle 3. The lock needles need not be in exact diametrical opposition to each other. It is sufficient

for them to be provided on the facing sides of the piles. Extending between the piles is a flexible screen 4, which is curved towards the water side, designated by W. Screen 4 is composed of a plurality of sheet piles 5, which preferably each have a cross-sectional shape with a radius of curvature approximately corresponding to that of the entire screen 4. The sheet piles 5 have clutches 6 and 7, a clutch 6 being adapted to be slipped into a clutch 7 to form a water retaining lock. At the lateral edges of the screen, clutches 6, 7 engage with one half of the double lock needles 3 secured to tubes 1, 2. In the plane of drawing, the facing lock needles 3 and locks 6, 7 of screen 4 are located on a line curved towards the water side W.

According as the curvature of the screen 4 is greater, and according as the screen comprises a larger number of sheet piles 5, the flexibility of the screen is greater. The use of double lock needles 3 makes it possible to provide a second screen 4', shown dotted in the drawing, between piles 1 and 2 for inspection purposes, which screen 4' is curved towards the land side designated by L. The space between screens 4 and 4' can be emptied for inspection of screen 4. Screen 4' can be removed again after the inspection or, if desired, the interspace may be filled with concrete.

Before screen 4 is driven, in the ground between piles 1 and 2 may be loosened, which may be effected in known manner using sand drills or otherwise.

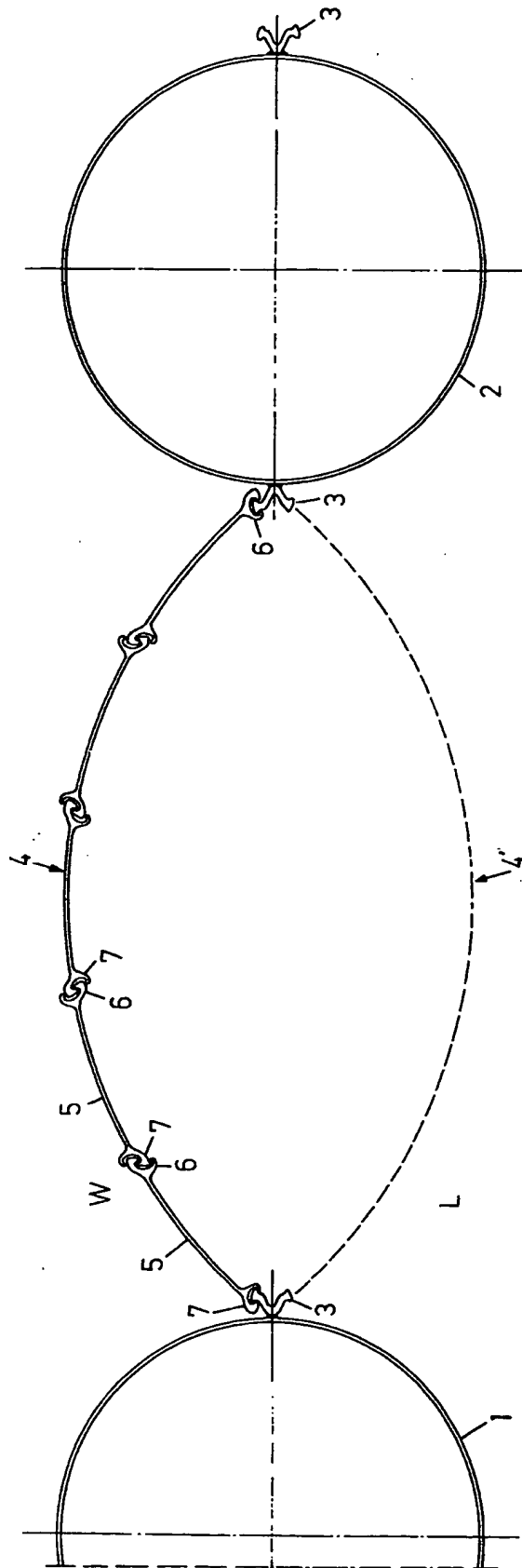
The piles may be anchored in the conventional manner.

It is clear that the invention is not limited to the embodiment described. Thus various pile configurations and sheet pile configurations may be used, but the
5 advantage contemplated by the invention is best realizable using round piles, in particular tubular piles, and as many flat, slightly curved sheet piles as possible, at least two. By virtue of its curved configuration and because the sheet piles can pivot relatively to each other
10 in the interlocks, the screen can adapt itself to possible non-parallelism of the piles and, if any deformation stress occurs at all, this will be a, slight, torsional stress in the individual sheet piles, which will not lead to the locks being forced.

CLAIMS:

1. A method of making a retaining wall or sheet-pile wall or in particular a composite wall composed of piles driven into the ground in spaced relationship and sheet piles interconnecting said piles and connected
5 to each other and to said piles by means of interlocks, characterized in that after the piles have been driven in, these are interconnected by a flexible screen which is placed, as a whole by either driving in all the sheet piles simultaneously or driving them in incrementally
10 and alternately at least two at the time, the sheet piles being placed in such an arrangement that, in horizontal section, their respective coupling points are spaced on a curved line.
2. A method as claimed in claim 1, characterized
15 in that the ground between the driven-in piles is loosened before the flexible screen is driven in.
3. A method as claimed in claim 1 or 2, characterized in that the piles used are tubular piles.
4. A method as claimed in any one of the preceding
20 claims, characterized by making a screen of at least three sheet piles.
5. A sheet pile wall made by the method as claimed in any one of the preceding claims.

6. A composite sheet-pile wall comprising tubular piles driven into the ground in spaced relationship, which piles are on their facing sides equipped with one or more lock needles, with a flexible screen of sheet piles extending between said piles, said sheet piles being interconnected by interlocks, which screen comprises at least two sheet piles and is connected to the pile lock needles, said lock needles and the interlocks between the sheet piles extending in a curved surface.
- 5
7. A composite sheet-pile wall as claimed in claim 7, characterized in that the sheet piles are each of curved cross-sectional configuration.
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8. A composite sheet-pile wall as claimed in any one of claims 5-7, characterized in that the lock needles connected to the tubular piles are of duplicate construction.
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EUROPEAN SEARCH REPORT

0029273

Application number

EP 80 20 1084

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl.)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
	<p><u>DE - A - 1 963 243</u> (CHRISTIANI UND NIELSEN)</p> <p>* Page 5, lines 14-18; page 6, paragraph 3; page 7, lines 4-6; figures 1,5 *</p> <p>--</p> <p><u>FR - A - 1 557 902</u> (CENTRE DE RECHERCHES PONT-A-MOUSSON)</p> <p>* Page 2, left-hand column, paragraph 3; figure 3 *</p> <p>--</p> <p><u>FR - A - 1 218 866</u> (LORRAINE-ESCAUT)</p> <p>* Page 1, left-hand column, paragraphs 2,5,6; figures 1-4 *</p> <p>--</p> <p><u>US - A - 2 002 521</u> (BORBERG)</p> <p>* Page 1, left-hand column, lines 50-55; page 1, right-hand column, lines 1-8; page 2, left-hand column, lines 38-60; figures 4,5 *</p> <p>----</p>	<p>1,3,6 7</p> <p>1,4</p> <p>1,6</p> <p>1,8</p>	<p>E 02 D 5/04</p> <p>TECHNICAL FIELDS SEARCHED (Int. Cl.)</p> <p>E 02 D</p> <p>CATEGORY OF CITED DOCUMENTS</p> <p>X: particularly relevant A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: conflicting application D: document cited in the application L: citation for other reasons</p> <p>&: member of the same patent family, corresponding document</p>
X	The present search report has been drawn up for all claims		
Place of search	Date of completion of the search	Examiner	
The Hague	23-02-1981	RUYMBEKE	